



NATURAL SODA

**2014 Mine Plan Modification
500,000 Tons Per Year**

**Volume 4, Section 6.0
Mining Plan**

Prepared for:
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Piceance Creek Basin
Rio Blanco County, Colorado

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Appendices

- Appendix 6A: (CONFIDENTIAL) – An Evaluation of Impacts of High-Extraction Solution Mining on Overlying Aquifers and Minability of Oil Shale, Agapito Associates, Inc., November 1995
- Appendix 6B: (CONFIDENTIAL) – An Evaluation of Geotechnical Impacts – Panel 2 Solution Mining, Agapito Associates, Inc., April 2002
- Appendix 6C: (CONFIDENTIAL) – “Re: Mine Plan to Support Plant Expansion.” Letter to Natural Soda, Inc. from Agapito Associates, Inc., June 13, 2014.

SECTION 6.0 MINE PLAN

6.1. Introduction

Natural Soda, Inc. operates the commercial-scale, saline mineral, solution mine. The plant was originally permitted to produce sodium bicarbonate at a rate of 125,000 tons per year (TPY). The BLM issued project approval in a November 20, 1987 Record of Decision (ROD). This section of the Mine Plan presents the NSI saline mineral solution mining plan and describes various facets of the mine, processing facility and regulatory requirements. Additionally, NSI wishes to present information regarding its plans for future mining methods and intervals, as well as future production capabilities.

NSI has endeavored to develop a mine plan that maximizes the utilization of the sodium resource in a manner consistent with the public goals of preserving the environment, natural resources, recreational and aesthetic qualities of the area. The economic benefit is shared with the public through royalty payments, taxes and employment. The NSI expansion will lead to an additional 25 permanent long-term employees and 10 to 15 permanent long-term contractors (i.e. haulage). The indirect job benefit based on a 3X to 4X multiplier is projected to be up to 150 positions. All operations have been and will be conducted under an approved Mine Plan.

As of the date of this document, the production output is rapidly increasing. NSI is in a strategic position to take advantage of a unique market opportunity and needs to rapidly increase sodium bicarbonate production as soon as practical. NSI is approaching the current facility design production limits and the current regulatory permitted production limits. Intelligent growth coupled with advances in technology and an ongoing research, development and demonstration (RD&D) plan are keys to company success. As such, NSI plans to enter into a second plant expansion program designed to incrementally but rapidly increase production capability to 500,000 tons per year. Completion of plant expansion is anticipated in 2016, with stepped production increases approaching plant capacity around 2017.

Concurrent with the plant expansion, NSI will move forward by continuing to better define the currently targeted nahcolite resources in the Boies Bed and potentially add saline mineral extraction capability to additional stratigraphic intervals of the Saline Zone.

Simultaneous diverse resource recovery in the region mandates heightened awareness and diligence from all parties involved. NSI will continue to engage in best management practices and implement best available technology. An open dialogue among all participants is encouraged. The important benefits from good communication include resource protection and shared knowledge. Cooperation efforts afford protection of environment and infrastructure, thereby potentially reducing production costs and disturbance to public lands.

6.2. Mine Plan Strategy

The primary Mine Plan goals are to economically mine saline minerals by optimizing resource recovery, protect underground sources of drinking water and preserve oil shale assets. While the nature of this plant requires a flexible mine plan, a predetermined basic strategy is necessary. The core elements of this strategy are:

- Position mining intervals for optimum resource recovery.
- Mine individual intervals to economic exhaustion.
- Closely monitor potential effects of mining on *Underground Sources of Drinking Water* (USDW) aquifers.
- Protect USDW aquifers by cementing well annuli to surface per Underground Injection Control (UIC) permit.
- Control Dissolution Surface aquifer pressure, thus preventing water movement from Dissolution Surface aquifer to B-Groove Aquifer.
- Protect the B-Groove Aquifer and oil shale assets from rubble-type collapse by utilizing cavity/pillar mining layouts and subsidence monitoring.
- Utilize sound engineering principles, best management practices, best available technologies and professional standards.

The intent is a flexible Mine Plan which can adopt improved geologic and hydrologic knowledge, drilling technology and solution mining methods within this predetermined strategy. The Agapito and Associates, Inc. reports, dated November 22, 1995 (Appendix 6A), April 8, 2002 (Appendix 6B), and 2014 (Appendix 6C) provide an evaluation of the potential underground impacts resulting from mining in this manner.

6.3. Resource Recovery and Production Rates

6.3.1. Sodium Bicarbonate Resources

A detailed description of geology on the Lease tracts is presented in Section 4.0. In addition, the estimates of resource quantities of nahcolite on the leases are presented. Resource estimates that focused on the southeastern portion of the Lease (historically called “Panel 2”, Figure 6-5) indicated 1,210,220 tons of nahcolite available for solution mining (Daub and Associates, Inc. *L-5 Zone Sodium Bicarbonate Reserve Estimate*, December 2009). In addition, the *2014 Core Hole Exploration Program* will further define the Boies Bed resources (Figure 6-1, Resource Delineation Program or RDP). Areas A through E, and P1 and P2, as shown in Figure 6-6 may provide significant nahcolite resource within the Boies Bed. Table 6-1 lists the potential Boies Bed Mining Areas along with an estimated Boies Bed Nahcolite production capability in potential millions mineable tons (pmmmt).

Mine Area	Number of Proposed Cavities	Approximate Cavity Length, ft	Potential Million Mineable Tons, pmmt (CONFIDENTIAL)	Comment
A	6	2,200		
B	2	815 and 905		
C	3	810 to 1,540		
D	6	1,525 to 2,200		
E	6	2,200		
P1	2	1,720 and 1,870		Lower Boies Bed cavities
P2	0	na	na	no proposed cavities in this area

Table 6-1. Proposed Boies Bed Mining Areas

Within existing Areas P1 and P2 (historically called “Panel 1” and “Panel 2”) and Areas A through E, there are millions of tons of recoverable nahcolite. If Area A is halitic in part and this area is not mined, Areas B through E and including P1 contain approximately seven million tons of recoverable nahcolite. Therefore, NSI has the capability to produce sodium bicarbonate operating at a 500,000 TPY capacity in excess of 10 years. The Boies Bed Nahcolite resource within the NSI Sodium Lease has been estimated in excess of 70 million tons. At a 500,000 TPY operating capacity, NSI could sustain a 140 year operation at 500,000 TPY. To maximize economic resource recovery, the mining plan is based on extraction of nahcolite from the Boies Bed, (L-5A bed up to the L-5E bed), coupled with ongoing research and development efforts designed to explore the potential extraction of saline minerals from additional portions of the Saline Zone (see reference to DVPW below). NSI will continue researching new solution mining intervals and methods. This Mine Plan will be modified, as necessary, to remain current with any improvements in mining techniques.

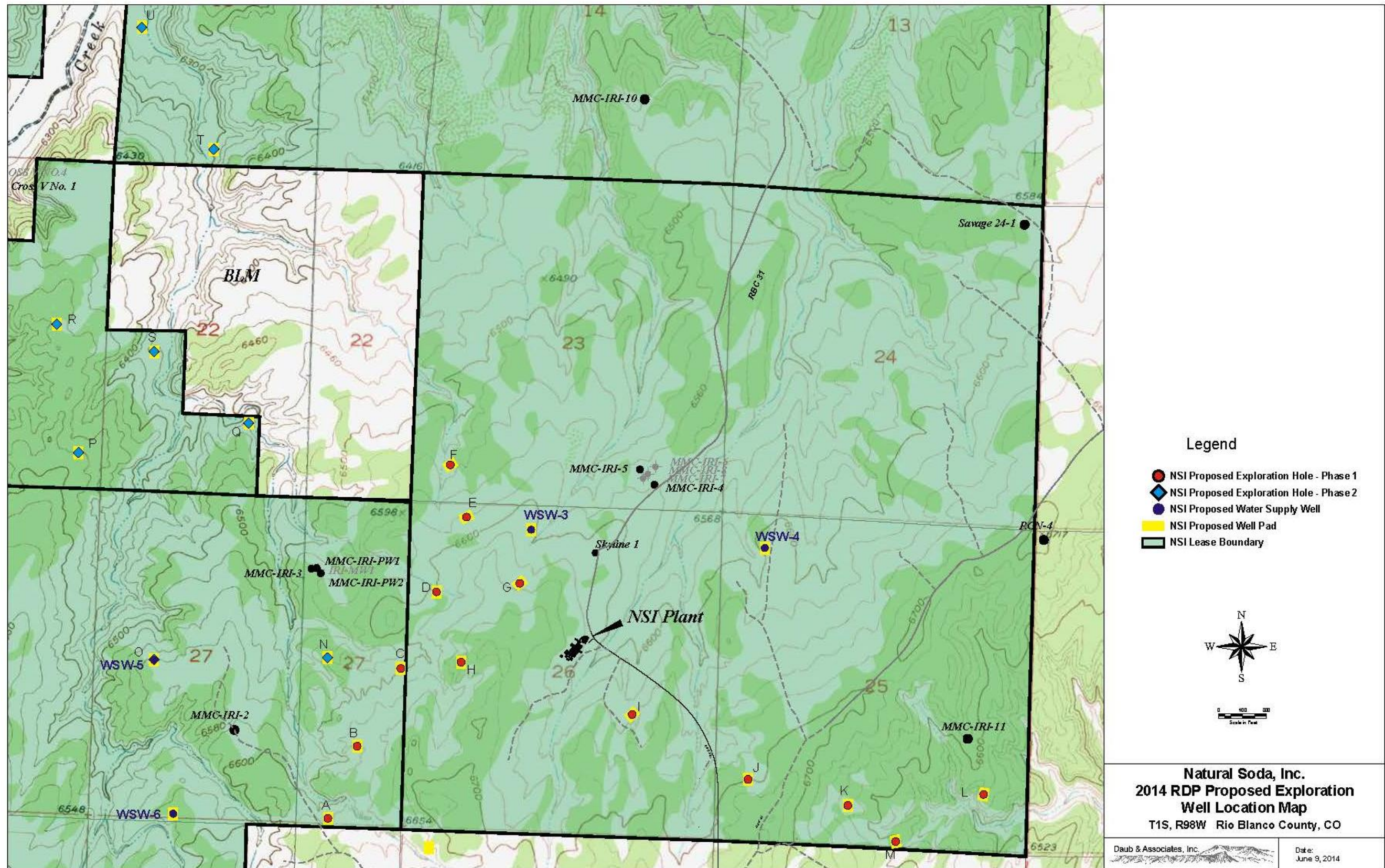


Figure 6-1. 2014 RDP Proposed Exploration Well Location Map

6.3.2. Production Rates

The facilities were originally constructed to produce 125,000 tons per year of high-grade sodium bicarbonate, while operating seven days per week, 24 hours per day, and with an 85% on-stream factor. Permit applications to allow construction and operation of a 3 ton-per-hour (TPH) pilot solution mining facility were submitted on October 4, 1983 and approved February 9, 1984. On May 2, 1986, an Environmental Assessment (EA) for a six TPH pilot-scale operation was approved by the BLM. On November 20, 1987, the BLM approved the NaTec Mine Plan for a commercial-scale (125,000 TPY) nahcolite solution mine. Construction started in May of 1990 for the process facilities. On July 8, 2010, a Technical Revision (TR-30) application for Permit No.M-1983-194 was submitted to the Colorado DMRS. The purpose of the TR-30 was to expand the Mine Plan and revise the Environmental Monitoring Program (EMP). The revised Mine Plan included an increase of commercial-scale production to 250,000 TPY. The Mine Plan expansion and EMP revisions were approved on September 7, 2010. At the current rate of production, this capacity will be reached in the fall of 2014.

Should the monitoring indicate that significant impacts are occurring which were not anticipated in the EIS, production will be shut down in accordance with Item 1, Appendix A, of the 1987 *Record of Decision* until a plan for mitigation is accepted by the Authorized Officer.

6.3.3. Oil Shale Protection Lease Restriction

The EIS states that, "Insignificant direct damage to overlying oil shale resources will occur as a result of drilling (i.e. the portion of rock that is drilled out will be destroyed or removed). If wells are properly constructed and properly abandoned, this damage will be offset by the information on the oil shale that will be obtained from the drill holes. No adverse impact is expected on the quantity, quality or future recoverability of the overlying oil shale; historical monitoring activities of the sodium cavities and overlying formations have indicated and confirmed this prediction. No impact to the oil shale resources below the Boies Bed is expected."

Agapito Associates, Inc. has concluded in three separate reports, prepared in 1995, 2002, and 2014 respectively, that high extraction mining as planned by NSI is possible without adverse impact on the minability of the Mahogany Zone oil shale or to the USDW aquifers.

6.4. Mining Stratiform Nahcolite

6.4.1. General Process

NSI currently recovers nahcolite by in-situ solution mining of the Boies Bed, a deposit near the top of the Saline Zone below the Dissolution Surface (DS) and above the R-5 oil shale zone. Hot unsaturated (barren) brine dissolves the nahcolite as it circulates through the Boies Bed stratiform interval (see Section 4 for a detailed description of stratiform and non-stratiform nahcolite). The pregnant (saturated) nahcolite solution is recovered from the cavity and routed to the process plant via a surface pipeline. An electric submersible pump is used for fluid recovery, as applicable, to avoid influences on the overlying aquifers. Heat exchangers and crystallizers cool the pregnant solution causing the dissolved nahcolite to precipitate as sodium bicarbonate crystals. The bicarbonate crystals are de-watered, dried, classified, packaged and shipped to market. After crystallization of the pregnant solution, the remaining, now barren, brine is reheated and returned to the cavities forming a continuous closed-circuit process. Figure 6-2 depicts the general flow process. NSI continues to conduct research and development for the recovery of sodium minerals located within other portions of the saline interval.

6.4.2. Mining Interval

The mine is located near the depositional center of the Piceance Creek Basin, which contains bedded and disseminated saline minerals and oil shale. Nahcolite (sodium bicarbonate) and halite (sodium chloride) are the primary saline minerals. Natural circulatory groundwater leaching has removed large portions of the nahcolite and halite deposit. The Dissolution Surface is a well-defined surface located between the groundwater in the Leached Zone and the remaining unleached, underlying saline minerals. The natural dissolution of saline minerals by groundwater has

resulted in collapse and fractures throughout the Leached Zone (between the top of the R-8 Zone aquifer and the Dissolution Surface). Below the Dissolution Surface, the saline mineral deposition is both stratiform and non-stratiform. Stratiform saline minerals consist of individual units and beds that represent deposition coeval with oil shale.

The relatively halite-free stratiform nahcolite sections of the Boies Bed are readily solution mined on the NSI Lease. The injection interval, as defined within UIC permit number CO 30358-00000, is located beneath the DS and comprises the Boies Bed (Figure 6-3). To the southwest of the plant area, the mining interval becomes devoid of stratiform halite (Figure 6-4, **CONFIDENTIAL**).

NATURAL SODA PROCESS FLOW

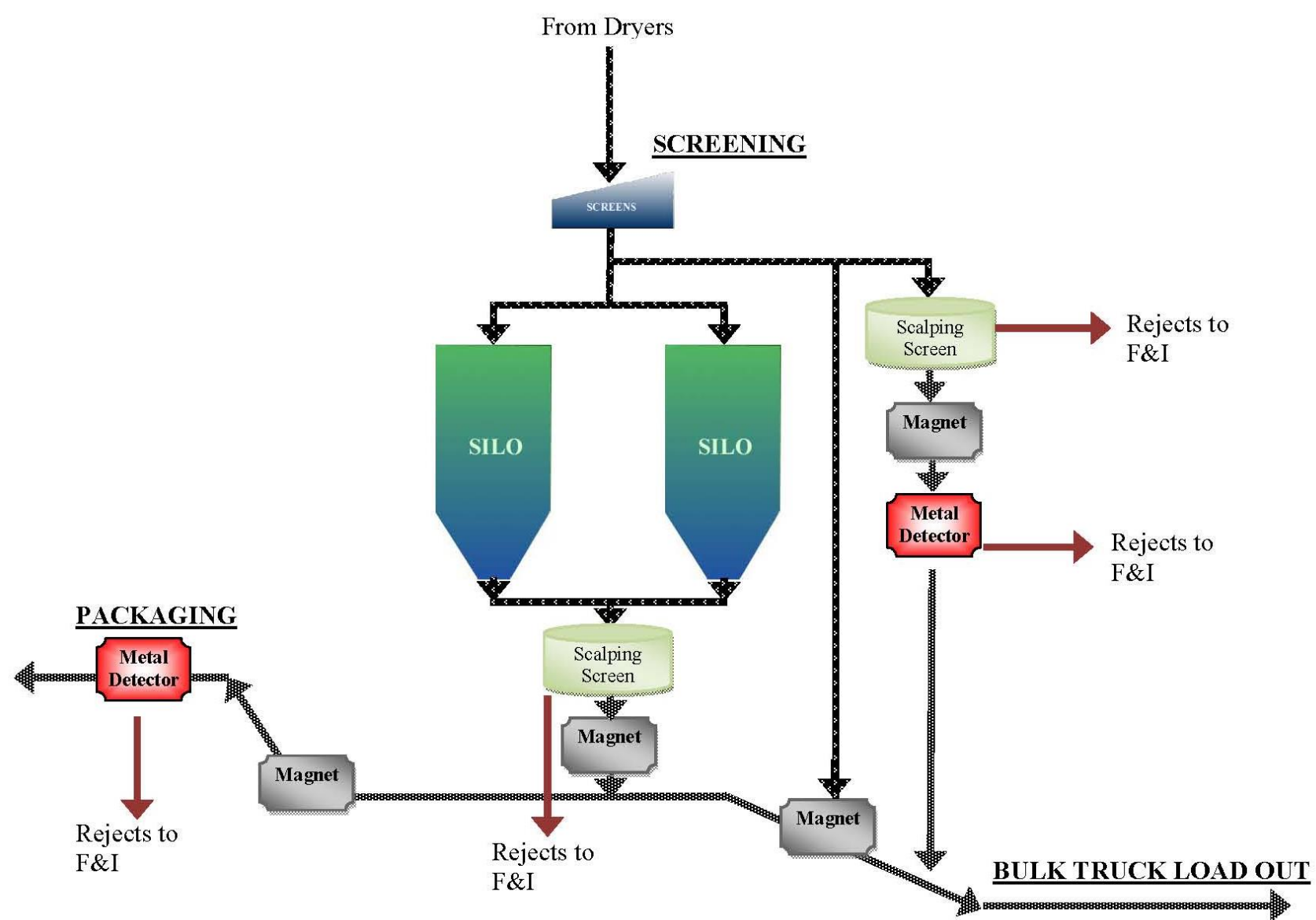
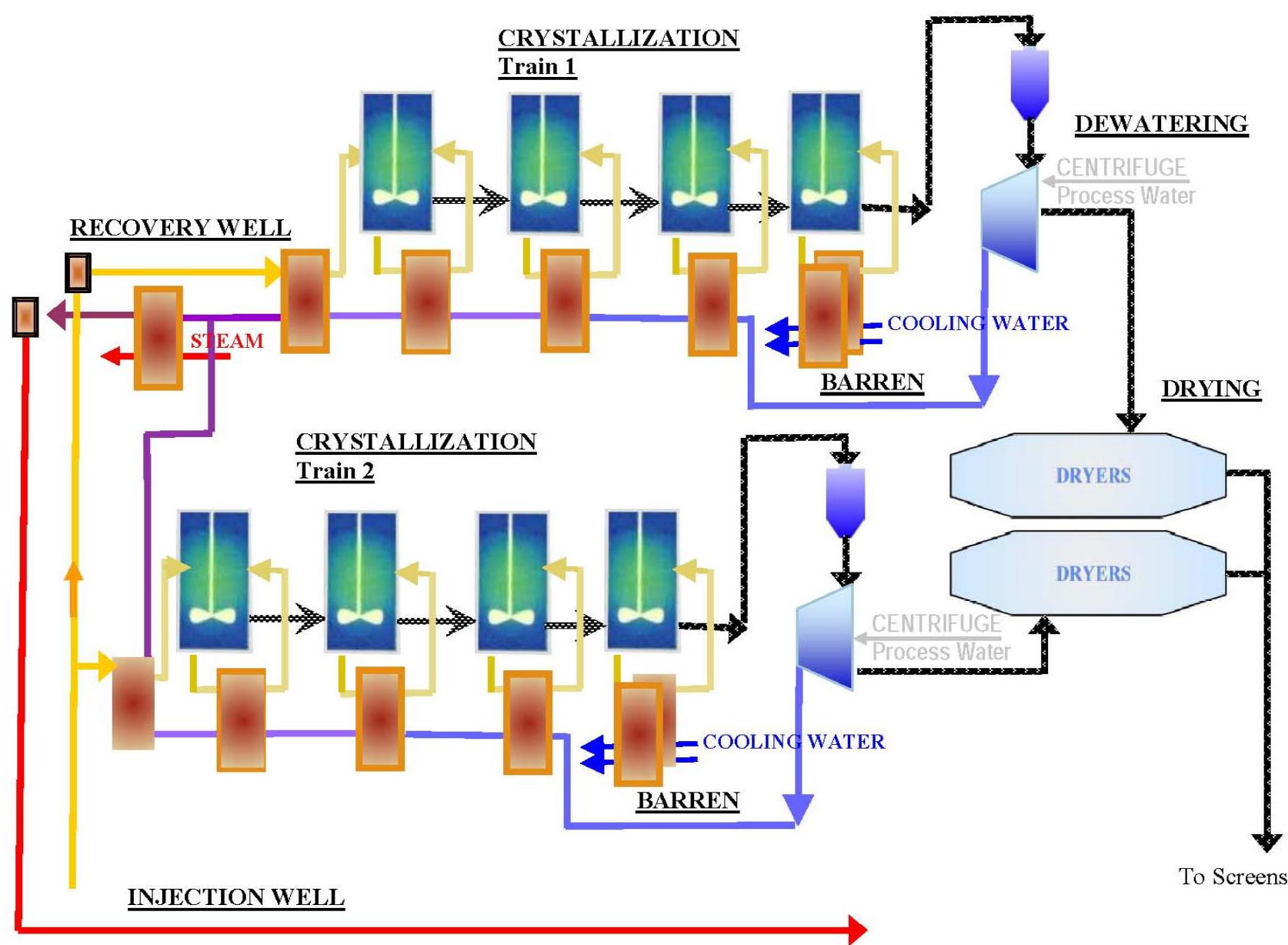


Figure 6-2. Process Flow Diagram

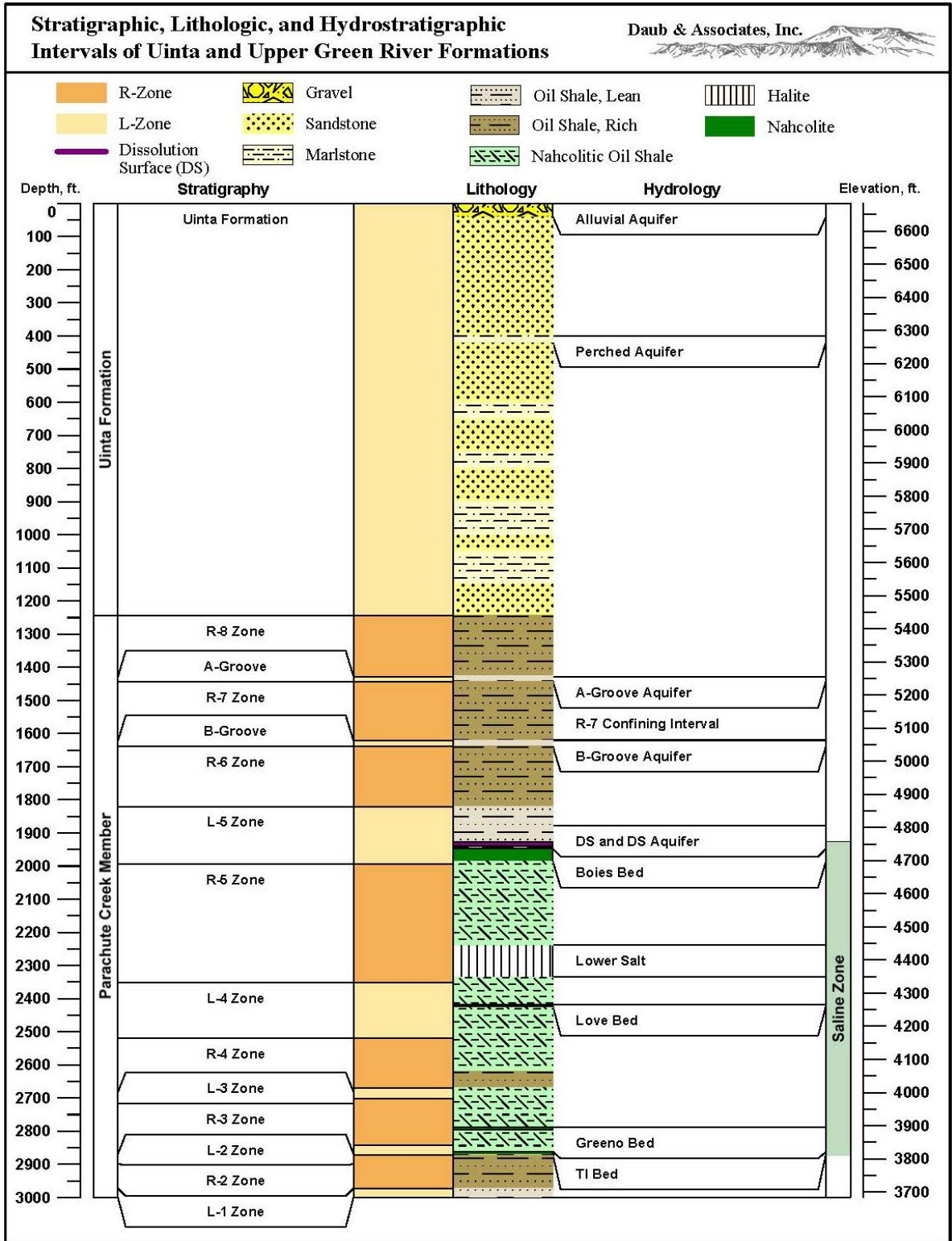


Figure 6-3. General Stratigraphic Column of the Piceance Creek Basin.

CONFIDENTIAL

Figure 6-4. Upper Boies Bed Saline Facies Map (CONFIDENTIAL).

The thickness of the nahcolite deposit decreases to the southwest of the plant. To the northeast of the plant area, stratiform halite replaces the nahcolite in a bed by bed replacement from the bottom of the L-5A bed upward.

Non-stratiform nahcolite exists as aggregates, nodules or individual crystals formed just below the fluid / lake bed interface and within the organic rich sediments. The oil shale containing the non-stratiform nahcolite has been the focus of the NSI RD&D Deep Vertical Production Well (DVPW) activity. All of the injection wells are permitted through the EPA Class III Underground Injection Control (UIC) permit application process.

6.4.3. Groundwater

Oil shale above the mining interval provides little primary porosity for groundwater storage. Aquifer storage is principally secondary porosity resulting from fracturing and dissolution of the preexisting stratiform and non-stratiform saline minerals, and is found in pits, vugs, and solution cavities. Within the lease area, four (4) groundwater aquifers are recognized: the Perched Aquifer, the A-Groove Aquifer, the B-Groove Aquifer and the Dissolution Surface aquifer. The Mahogany Zone, a leaky, semi-confining oil shale, separates the A- and B-Groove Aquifers. Process water is currently supplied to the plant from two A-Groove water supply wells (90-1 and WSW-2). Two new water supply wells, WSW-3 & WSW-4, will be drilled and completed in 2014. The 90-1 well will be taken off-line and utilized as an A-Groove Aquifer monitor well. Pump tests have established that water pumped from the 90-1 water supply well creates a 360-degree inward flowing cone of depression. A coinciding cone of depression is transmitted to the B-Groove Aquifer through fractures in the leaky, semi-confining Mahogany Zone. However, the cone of depression is not transmitted below the B-Groove to the Dissolution Surface (DS) aquifer.

The DS Aquifer is isolated from the B-Groove Aquifer by a 250-foot thick fractured oil shale confining layer, known as the Leached Zone. Baseline hydrologic exploration determined that the piezometric pressure in the DS Aquifer is slightly less than the pressure in the B-Groove Aquifer. In an open exploration hole, it was observed that

the A and B-Groove waters moved downward and entered the poorer quality water of the DS Aquifer. This pressure gradient and flow direction protects the A- and B-Groove Aquifers' water quality.

Although both the A- and B-Groove waters near the depositional center of the basin are of poor quality, both are protected as potential USDW. The on-going natural leaching of saline minerals in the DS aquifer result in total dissolved solids (TDS) concentrations greater than 10,000 ppm. Therefore, the EPA does not consider the DS Aquifer to be a potential USDW. Above the A-Groove, the Perched Aquifer lies in the Uinta Formation sandstone layer. This sandstone layer has variable porosity due to natural cementation. The Perched Aquifer is discontinuous and is a minor regional component of the groundwater system.

6.4.4. Operating Plan

A key element of this mine plan is the control of the DS Aquifer piezometric pressure such that the A- and B-Groove Aquifers are not impacted by saline water from the DS Aquifer. Redundant operational controls and continuous DS monitoring feedback are utilized. Operational controls include: the plant water inventory balance, control of injection and recovery rates, and production well and DS Aquifer piezometric data. The inventory balance and flow rate management allow operational control while more precise control is provided by continuous water level monitoring via pressure transducers. Water quality and fluid level monitoring information is included in the NSI Environmental Monitoring Plan (submitted under separate cover). Additional information on the operation can be found in various subsections of this part of the Mine Plan.

6.4.5. Mining Methods

NSI solution mines saline minerals with a production well pair consisting of an injection and recovery well. Various methods of mining have been employed to recover saline minerals, including directionally drilled vertical, slant, and horizontal production wells. Dual horizontal well pairs have proven to work well for solution

mining in the stratiform Boies Bed. In addition, currently unknown mining methods and technological advances may be identified and employed in the future.

For the recovery of stratiform saline minerals, directionally drilled horizontal wells can be either injection (I) or recovery (R) wells and may potentially vary in horizontal length from 800 feet to approximately 2,500 feet. Upon well completion, mining begins and the cavity is developed. Various types of well configurations have been used to develop cavities using this method: one method uses two horizontal wells, which are interconnected at a strategic point; another method utilizes one long horizontal well and a single or multiple vertical well(s) that intersects the horizontal well. A third, less preferred, method utilizes horizontal wells which are connected into existing horizontal wells at various angles. This plan does not cover every type of configuration available, but tries to indicate the wide range of diversification required to meet production requirements tempered by capital constraints.

Vertical production wells may be located at strategic points along cavities formed by using the directionally drilled horizontal wells. To ensure the cavities are developed symmetrically, these wells may be orientated and located based on the dip, thickness and purity of the Boies Bed. These wells may be alternated from injection to recovery and back to control cavity growths and shape. Additionally, vertical wells may be mined as an independent interval, providing an alternative to horizontal borehole mining. The vertical wells provide a larger directional-drilling target that can act to create a sump for settling insoluble material which aids in the recovery of more saturated solutions. Well construction would be similar to vertical wells used for horizontal borehole mining but with an additional string of casing. This mining method also offers research and development opportunities and may improve the efficiency and predictability of horizontal mining.

Any of the above mining methods may be used with controlled leaching techniques. For example, undercutting is a common solution mining practice, in which an inert fluid cap is placed near the top of the mining interval to improve the vertical to horizontal leach rate. Cap material is commonly propane, methane, air, nitrogen or other inert gas. High-pressure jets can also improve cavity shape by cutting vertical

or horizontal slots in the ore before mining. Low pressure jetting during the mining phase can also be used to improve the cavity shape. Improved cavity shape enhances subsidence control and resource recovery. Mining control with respect to current preferred technology (dual horizontal wells) is accomplished with retreat mining by establishing multiple injection points through plugging and perforating the injection casing.

Fluid flow through the cavities may be accomplished through injection pressure where no significant leakage is anticipated or detected. In areas prone to communication, submersible pumps will be used, as applicable, to lift the pregnant solution and avoid pressurizing the formation below the DS Aquifer. Mining is anticipated to continue until the cavities are exhausted. Excessive halite or temperature drop are the primary indicators of cavity exhaustion. New solution mining technologies may be employed as needed to reflect capital demand and efficiencies, maximize recovery, maintain cavity control and stability, and overcome adverse geological conditions.

Future mining methods may employ these solution mining methods in various combinations. As with any long range mine plan, modifications may be necessary as mining methods are changed as new technologies are developed and implemented. All modifications will be reviewed with the appropriate agencies prior to implementation.

6.4.6. Mining Areas

NSI established the “mining area” concept (historically called “panels”) with the initial development of the Boies Bed resource (Figure 6-5). Currently, Mining Area P1 (historical Panel 1) has been exhausted above the Oil Shale Marker Bed (OSMB). Continued development of existing Mining Areas is planned. In addition, Areas B, C, D, E and F will be developed. The two existing areas are approximately 800 feet wide and up to 3,000 feet in length (approximately 55 acres). Each of these areas was estimated to contain approximately 50,000 tons of nahcolite per acre within the Boies Bed.

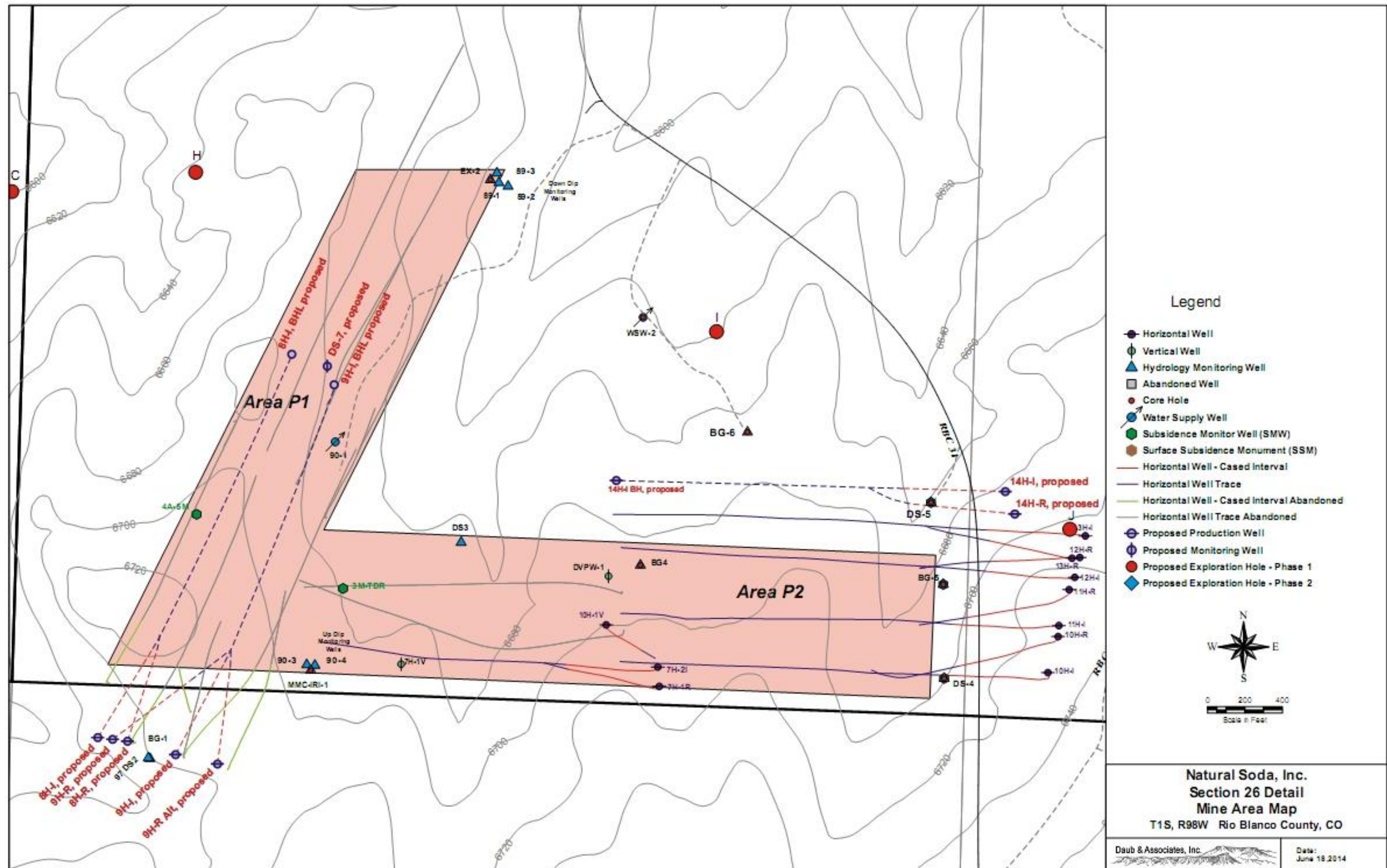


Figure 6-5. Historical Mine Panel Map.

It will become necessary to modify the dimensions and shape of future Areas as new solution mining and drilling technologies are developed with consideration to capital, resource, facies changes and production constraints. In addition, modifications to the mining plan may be necessary if increased salt (halite) content or subsurface issues are encountered in the panels. The Authorizing Officer has approved mining to within 100 feet of the Sodium Lease boundaries. A conceptual layout for Areas A (nahcolite dependent), B, C, D and E is shown on Figure 6-6 **(CONFIDENTIAL)**. The estimated recoverable nahcolite identified by Areas P1 and P2 (historical Panels 1 and 2) and areas A-E are capable of supplying the plant for more 20 years at a production level of 500,000 tons per year of sodium bicarbonate. The 2014 core hole drilling program is designed to better define nahcolite resources/reserves and the nahcolite/halite relationships throughout the NSI sodium lease area.

6.4.7. Mining Procedures – Stratiform Saline Minerals

NSI will continue to mine areas containing stratiform nahcolite utilizing horizontal drain holes for resource recovery. Past mine plans have included a goal of 48,000 tons per acre of nahcolite recovery from these panels. To accomplish this goal, the plans targeted an average of 221 tons nahcolite recovery per foot of cavity. Historical mining experience continues to be consistent with projections.

NSI plans to maintain approximately 200 foot spacing between cavity centerlines (initial horizontal well bores), based upon mining experience from as many as 11 preexisting cavities. It is the plan to mine the subsequent cavities to economic exhaustion with a resource recovery of approximately 40 percent. NSI will continue to periodically move cavity injection points or reverse flow within the cavities to achieve uniform panel mining and maximize resource extraction. Unrecovered resources in mining areas currently serve to minimize potential for subsidence, none of which has been detected to date.

CONFIDENTIAL

Figure 6-6. Mine Panel Map (500K TPY Production) (CONFIDENTIAL)

6.4.8. Drilling, Completion and Abandonment Details – Stratiform Saline Minerals

6.4.8.1. Well Drilling Permitting Procedure

As additional mining and monitoring wells are required within the Lease boundary, well permit applications will be submitted for approval to the Authorized Officer. In addition, a BLM Right of Way (ROW) application is required for wells that are drilled outside of the Lease boundary. For example, it may become necessary to drill wells off the lease to recover the resource along certain lease boundaries. The Application for Permit to Drill or Reenter (APD) will be reviewed and approved with potential modifications by the Authorized Officer within 30 days of receipt. The Authorized Officer can verbally approve changes to an approved APD as long as the change conforms to the Mine Plan. Cases such as the loss of a well or provisions needed for personnel safety may require immediate corrective action. Written Sundry Notices will follow in a timely manner for all changes to the APD. The Authorized Officer will be notified 24 hours prior to commencement of drilling and geophysical logging operations.

6.4.8.2. Horizontal and Vertical Well Drilling and Completion

Surface casing will be of a size, weight and API grade; and set at a depth to sufficiently support the wellhead stack. Once in place, the surface casing must maintain a seal while drilling the well with pressurized drilling fluids.

Surface casing will be set and cemented using a volume of cement calculated to fill the annulus from the setting depth to the surface. Any un-cemented annulus near the surface will be topped off using cement.

Two non-specific examples of surface casing and cementing specifications follow:

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A diverter and/or Blowout Preventer (BOP) may be installed on top of the surface casing once the surface casing is cemented in place. The working pressure of this device will be greater than 1.0 times the True Vertical Depth (TVD) of the well.

Production casing will be sized to facilitate successful completion and operation of the well. Casing will be designed using the following safety factors:

CONFIDENTIAL

Two examples of production casing follow:

CONFIDENTIAL

The production casing shoe will be set near the middle of the Boies Bed. Casing setting depths may vary based on drilling conditions and/or mining interval thickness, but BLM approval is required regardless.

NSI will cement the production casing in place from the shoe or DV tool (second stage long-string cementing tool) to the surface. Cement can range from light to heavy weight to nitrogen foam cement slurries. A cement bond log (CBL) will be run to confirm at least 100 feet of “good” annular cement bond below the B-Groove Aquifer. This minimum requirement will properly support the casing and isolate the B-Groove Aquifer from the mining activity. To accommodate for lost cement, a volume of excess cement will be calculated and used. Above the B-Groove Aquifer the un-cemented well bore may be filled with high viscosity cement or a mix of bentonite mud and cement. Cementing material will adequately prevent aquifer co-mingling. The casing will be cemented above the Perched Aquifer and topped off, as necessary, by placing or pumping cement down the annulus from the surface.

Adequate wait-on-cement time shall be observed for all cementing operations to achieve a minimum of 500 psi compressive strength. The wireline tool for establishing cement bond will be a cement bond log (CBL) with transit time, variable density log (VDL), gamma ray (GR), casing collar locator (CCL) and amplitude or pipe energy (measured in mv), or other equivalent tools such as a CAST-F, CAST-M, or CET. Reasonable attempts will be made to record the cement bond using a CBL tool, starting from the lowest practical point reached and, extending to the top of the cement. Logging for an additional 100 feet of free pipe will be recorded. Recording less than the above minimums will require the Authorized Officer to waive the requirements. A Sundry Notice will follow to confirm verbal approvals.

Directionally drilled horizontal boreholes will extend along or within the floor of the Upper or Lower Boies Bed. A casing liner will be installed and attached to the production casing injection well and extend to the end of the horizontally drilled well section. This section of injection liner will be suspended by a liner hanger and not cemented in place. As the cavity is mined, “retreat mining” will occur whereby the

injection point will be relocated by plugging and perforating the casing at designated locations. This retreat mining method will ensure the cavity is developed symmetrically along the length of the injection liner. Two typical suspended casing liner specifications follow:

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Casing liners will be sized based on well flow requirements, bit size used to drill the open hole, availability and price.

6.4.8.3. Drilling Problems and Contingency Plans

Casing Modifications

If production casing run in the hole is unable to reach into the top of the Boies Bed, due to poor well bore conditions, the production casing may be cemented in place. A casing liner will then be set to the top of the Boies Bed using a liner hanger and cemented in place. Casing design for the wells may change based upon availability at the time of drilling, well problems, drill hole conditions and resource thickness. The authorized officer, or his designee, will verbally approve any changes to the previously approved APD, followed by a written Sundry Notice.

Well Bore Plug Back

During any drilling operation, if the Boies Bed roof is penetrated at an unacceptable angle, the well bore may be plugged back with cement to an acceptable kick-off point (KOP) for re-drilling. The plug back is a drilling requirement, not a mining condition.

Circulation/Cementation

Lost circulation is problematic in the central part of the Piceance Creek Basin, often compromising well bore cementing results. Cementing results may be enhanced by the use of DV tools, cement baskets, centralizers, scratchers and/or other cement tools and modified cement slurries to ensure the proper encasement of the production casing. NSI personnel will verify the annular cement. If NSI establishes that cementing did not satisfy the minimum requirements, the Authorized Officer will be contacted to evaluate a waiver of minimum requirements and cement plans. NSI is committed to protection of all USDW aquifers from the mining interval. When possible, shooting and cement squeezing will be utilized for this purpose. Experience has shown that when the cement used to isolate the well bore from the aquifers is brought to surface during the primary cementing job, the column of cement on the backside will fall back. In this case, a cement mixture will be pumped or poured down the backside until its level can be maintained to surface.

Orientation

The orientation of the horizontal well pair may change as production, lease, subsurface, mechanical, resource characteristics, previous experience and technological knowledge advances.

Removal of Casing Liner

If the casing liner cannot be pulled and attempts to free it are unsuccessful during retrieval, the liner may be cut, recovered and reused if it is not compromised. Close inspection of the casing liner is paramount for reuse. The production liner may be abandoned in place when cavity exhaustion is achieved and the injection well is plugged and abandoned. If other methods are necessary, approval will be requested from the Authorized Officer.

Length of Horizontal Hole

The horizontal injection production wells may range from approximately 800-feet in length to 2,500-feet in length. The distance from recovery wells will be variable. Cavity length is a function of the horizontal drilling technology and downhole conditions. Cavities in excess of 3,500 feet are achievable using the current drilling equipment. If lengths greater than the distance previously granted in the Sundry Notice are advantageous and achievable, permission may be requested from the Authorized Officer to continue.

Fishing Operations

If the drilling assembly or borehole equipment becomes stuck downhole and recovery efforts are unsuccessful, cementing and side tracking may be utilized.

Short Radius Drilling

The technique of short radius drilling may be incorporated to connect the well bore to existing cavities. This method of drilling employs a short radius drilling technique, through which a nozzle and hose are directed to change from vertical to horizontal direction. The nozzle employs high-pressure water to drill through the horizontal formation. Vertical wells may be drilled to inject and recover production fluids.

6.4.8.4. Well Abandonment

Reporting Requirements

A "Notice of Intent to Abandon" will be submitted by NSI to the Authorized Officer before abandonment of any well. The notice will contain an "as-built" downhole diagram of the well and will describe any changes from the approved abandonment/plugging procedures. The Authorized Officer (BLM and/or EPA) will review and approve, or approve with modifications, the notice within 30 calendar days of receipt. A Sundry Notice will be submitted for both the "Intent to" and "Subsequent" notices.

Production Well Abandonment Procedure

Class III UIC well plugging and abandonment procedures are outlined in the EPA instructional UIC document. Plugging and abandonment of these wells will take place once it has been determined that there shall be no potential further use of a well, either for mining, testing, monitoring, or other purpose. Immediately prior to plugging and abandoning a cavity and associated wells, an attempt may be made to retrieve any tubing, liner or packer system located in the casing. The plugging and abandonment plan for the wellbore submitted by NSI and revised by the EPA, consists of either cementing the wellbore above the bridge plug to the surface with cement or setting five (5) plugs with the following specifications: The wellbore will be conditioned for plugging and abandonment by displacing the nahcolite brine in the wellbore with either bentonite, plugging gel, or other suitable fluid (approved by the Director upon submittal of the notice to plug). The operator shall run into the wellbore with a tubing string to the bottom of the casing. A cast iron bridge plug (CIBP) shall be set near the bottom of the casing. After the bridge plug is set in the conditioned hole, a cement plug to the surface shall be placed or the individual plugs shall be sequentially set by using one or more of the approved methods described in 40 CFR § 146.10. If the casing is not cemented to the surface from the top of the bridge plug, the cement plugs shall be set at points in the wellbore preventing migration of fluid within the casing. The exact depths for cement plugs are not specified, but the anticipated locations for setting cement plugs are:

Plug #1: The lowest plug shall span the entire Dissolution Surface aquifer from the CIBP, the water producing zone plus fifty feet above.

Plug #2: The second plug shall begin fifty feet below the water producing zone of the B-Groove Aquifer, bridge the entire aquifer and extend fifty feet above the aquifer.

Plug #3: The third plug shall begin fifty feet below the water producing zone of the A-Groove Aquifer, bridge the entire aquifer and extend fifty feet above.

Plug #4: The forth plug shall begin fifty feet below the Perched Aquifer, bridge the entire aquifer and extend fifty feet above.

Plug #5: The final plug shall be from one hundred sixty feet below ground surface to ground surface. A 9.2 pounds per gallon (ppg) plugging gel, Bentonite mud, or cement shall be placed between each plug.

The casing will be cut off below ground level, a plugged and abandonment (P&A) marker with well data will be installed, and reclamation activities shall commence per BLM specifications.

6.5. Process Monitoring

Process monitoring includes continuous monitoring equipment to record flow rate, pressure and temperature of the injection and recovery fluids. Pressure and temperature measurements consist of local (near wellhead) and remote (at the plant control room) sources of data. Flow data is recorded by the distributed control system (DCS), which captures the injection and well flow rate, and the flow data from the pregnant liquor tank. Pressure and temperature are monitored continuously, with four-hour maximum/minimum and average readings printed for daily records. Monthly and quarterly reports summarize the daily readings. The following is a list of process control monitoring items:

- Initial water quality of the injection fluids for major ions, TDS, pH, specific conductivity and specific gravity, and whenever a new source of supply water is utilized. A flow line tap is provided for obtaining representative samples of the injection/recovery fluids.
- A pressure indicator is located near each well head. Continuous readings are recorded. In addition, a tap is provided near each well head for local pressure readings.
- A flow meter is installed on each well. Based on historical data and a potential for inaccurate recovery readings (due to gas bubbles), the injection flows are utilized to monitor flow to cavities; total flow from the pregnant liquor tank is utilized for recovery data. To differentiate pregnant liquor flow from each cavity, the flow will be recorded from each individual cavity on a periodic basis.

- Downhole submerged pressure transmitters are installed in Dissolution Surface monitoring wells within the active mining panel. Data from these transmitters are trended in the Process Control Room to provide operating personnel with an indication of any pressure imbalances between the mining cavity and the Dissolution Surface so corrective actions can be taken.
- Temperature sensors monitor the temperature of injected and produced fluids.
- The specific gravity of the produced and injected fluid is monitored at least weekly. Sodium bicarbonate analyses, in grams/liter, are obtained from injection and recovery solutions at least once per week to determine production from each cavity.
- The maximum allowable injection pressure (MAIP) is limited to 300 psig, as measured at the surface (UIC, Part II.C.2).

An Environmental monitoring program for monitoring surface and groundwater, subsidence and other environmental factors may be found in the Environmental Monitoring Plan (submitted under separate cover).

6.6. RD&D Plan – Deep Vertical Production Well (DVPW) **(All of section is CONFIDENTIAL)**

6.6.1. Introduction (CONFIDENTIAL)

6.6.3. Objectives (CONFIDENTIAL)

6.6.4. Pad Location and Mining Interval (CONFIDENTIAL)

CONFIDENTIAL

Figure 6-7. DVPW Location Map (CONFIDENTIAL)

CONFIDENTIAL

Figure 6-8. DVPW Generalized Cross-Section (CONFIDENTIAL)

CONFIDENTIAL

6.6.5. Mining Procedure and Mined Interval Development
(CONFIDENTIAL)

CONFIDENTIAL

Figure 6-9. DVPW Well Completion Diagram (CONFIDENTIAL).

6.6.6. Mining Activity Monitoring (CONFIDENTIAL)

CONFIDENTIAL

6.6.7. Well Abandonment and Pad Reclamation (CONFIDENTIAL)

6.7. Environmental Monitoring Plan

The NSI Environmental Monitoring Plan (submitted under separate cover) is a stand-alone document which was prepared for the Bureau of Land Management (BLM), Environmental Protection Agency (EPA) and the Colorado Division of Reclamation, Mining and Safety (DRMS) pursuant to requirements concerning the commercial-scale nahcolite solution mining project in Rio Blanco County, Colorado.

NSI operates, monitors, and reports in accordance with the most current stipulations of the BLM Record of Decision (ROD), the EPA Area Underground Injection Control Permit (UIC) CO30358-00000, the DRMS Permit M-1983-194, and subsequent conditions of approval and required mitigation. NSI submits routine reports to the BLM, EPA and DRMS. Should there be a discrepancy between the ROD, UIC or DRMS Permit (Permits) and this Monitoring Plan; the Permit requirements will take precedence.

The BLM, EPA, and DRMS mandated monitoring programs are comprehensive, intended to provide the agencies with a means of determining surface and subsurface environmental impacts. The monitoring plan is designed to enable detection and/or evaluation of biologic and hydrologic impacts.

The Permits were approved for the operational life of the project. The regulatory agencies and NSI continue to proceed on a phased approach based upon the Mine Plan, which provides detailed plans, current operations, and anticipated operations anticipated for the next five to ten years and general plans for long term. The project will continue operations if monitoring results do not indicate significant negative impacts.

The Environmental Monitoring Plan will be updated periodically to remain current with respect to areas being mined. An updated Environmental Monitoring Plan will be submitted to the appropriate agency for review and approval prior to implementation.

6.8. Affected Acreage

Construction and operations at the solution mine site are anticipated to ultimately affect a maximum of 260 total acres of land. The NSI 2013 Project Status Report indicated 31.3 acres of disturbed land for the process area and 35.8 acres of disturbed land in the well field for a total of 67.1 acres of disturbed land. Disturbed areas will be reclaimed in a timely manner and consistent with the reclamation program. The reclamation program is discussed in more detail in Section 8.

6.9. Rock Mechanics and Subsidence

6.9.1. Rock Mechanics

In addition to Agapito Associates, Inc. (AAI) report dated 1995; many core holes and other applicable rock mechanics work has been conducted in the Piceance Creek Basin. This data indicates that the NSI mining concept continues to be valid. AAI has conducted an independent analysis of the potential for adverse impact to the overlying USDW and oil shale in the Mahogany Zone. In a June 2014 review of earlier work by AAI on this subject dated in 1995 and 2002, AAI noted that the proposed mine plan is based on the same guidelines as listed above and outlined in the 2002 letter report. This review is presented as Appendix 6C.

6.9.2. Boies Bed Mining Evaluation

High-extraction mining separated by barrier pillars is recommended to control the potential caving above the mined interval and to minimize surface subsidence. Forty-percent extraction of the available nahcolite resources in and above the Boies Bed and below the DS within such panels is possible without adverse impact on the minability of the *Mahogany Zone* oil shale or the upper aquifers per Appendix 6A. Coupled with other data and future mining experience, recovery of more than 40% of the available nahcolite may be possible without damage to the aquifers or oil shale minability.

6.9.3. Solution Mining Groundwater Effects

For more than two decades, Natural Soda, Inc. has tested and established a credible baseline for groundwater quality information on four aquifer systems in the Piceance Creek Basin. In 1995, the operation incurred a variance in the A-Groove Aquifer water quality in the 90-1 well, directly above the mining zone. Up to that time, the established solution mining technology was to inject barren brine into the cavity under pressure, thereby forcing saturated brine to surface for processing. An anomaly in the pressurized cavity allowed mining fluid to infiltrate a portion of the A-Groove Aquifer directly above the mining zone. This variance was corrected by developing the current mining technology of installing submersible downhole pumps in the recovery wells and maintaining mining cavity pressures in equilibrium with the Dissolution Surface. The localized reduction of water quality in the A-Groove Aquifer was remediated by utilizing the 90-1 well as a water supply well for the Processing Plant, thereby consuming this lower quality fluid. The 90-1 well parameters are approaching baseline conditions, and no impacts from this variance were seen up-dip or down-dip from this well.

Long-term pumping of the A-Groove Aquifer (1990-2014) indicates hydrologic communication between the A- and B-Groove Aquifers, but not upward to the Perched Aquifer or downward to the DS Aquifer. The DS Aquifer is the only aquifer within the zone of possible significant caving or subsidence resulting from Boies Bed solution mining. The DS Aquifer is recognized by the EPA as a non-protected aquifer due to its poor water quality. It is not a USDW.

The A-Groove Aquifer is separated from the B-Groove Aquifer by a leaky, semi-confining layer commonly referred to as the Mahogany Zone. At both the NSI and U.S. Bureau of Mines (BOM) Horse Draw facilities, aquifer testing has determined that significant communication between upper (A-Groove) and lower (B-Groove) aquifers does exist. At all of the NSI monitoring locations, the potentiometric head of the upper three aquifers is historically higher than that of the DS Aquifer. Consequently, should communication between the upper aquifers be caused by mining-induced subsidence or fractures, the result would be that additional water

flows from the upper aquifers to the “lower quality” DS Aquifer. The use of submersible pumps since May of 1995 has decreased the potentiometric head in the DS Aquifer. NSI controls cavity pressure by balancing solution injection and recovery. Following mining, potentiometric levels are expected to recover to historic levels. Extensive monitoring will be conducted to verify that effects are limited to DS Aquifer wells. Additional details may be found in the Environmental Monitoring Plan.

In addition to the historic potentiometric head differential, it has been concluded that any groundwater effects would be minimal as saline or high-density water will remain at the bottom of the aquifer. In the long term, the high-density water in the caved rock and rubble-filled Boies Bed cavity will stagnate; thus, this will not significantly alter the groundwater quality in the overlying aquifers. As previously described, local effects on groundwater (found within the three protected aquifers) resulting from subsidence should be minimal. No surface subsidence has been detected through 2013. It is unlikely that any effects would be observed on a regional basis. Undetectable changes may occur in the three protected aquifers due to the caving and subsidence induced by solution mining.

Significant additional hydrological knowledge has been gained by the monitoring system. No mining effects have been detected on the A-Groove, B-Grooves or Perched monitoring wells.

6.9.4. Surface Subsidence

The EIS estimate of potential surface subsidence was less than one foot. A current estimate of surface subsidence is less than 0.6 feet. Surface subsidence will be uniform in aerial extent over the area to be mined. Subsidence expressed at surface of this type will not hinder post-mining land use as range/wildlife habitat and will be uniform (e.g., a gradual sag). The surface expression of subsidence should be undetectable except by survey methods. In other words, no appreciable changes in surface topography will occur. Solution mining of the Boies Bed since 1991 has resulted in no detectable surface subsidence.

6.10. Engineering Standards

The plant facilities, associated evaporation ponds, load-out unit, access road, utility pipelines and power lines were designed and constructed under the direction of professional engineers. All planned plant improvements and expansions will be designed and constructed under the direction of a professional engineer using Best Available Technology (BAT) and Best Management Practices (BMP). NSI anticipates that new facilities will be required. All new facilities will be designed and constructed using BAT and BMP under the direction of a professional engineer (Section 7).

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NATURAL SODA

2014 Mine Plan Modification 500,000 Tons Per Year

Section 6.0
Appendix 6A
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NATURAL SODA

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NATURAL SODA

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